PROCEEDINGS

OF

THE ROYAL SOCIETY.

1842. No. 55.

November 17, 1842.

The MARQUIS OF NORTHAMPTON, President, in the Chair.

The following gentlemen were, by ballot, elected Auditors of the Treasurer's Accounts, on the part of the Society: viz. Martin Barry, M.D., Henry James Brooke, Esq., Robert Brown, Esq., D.C.L., Rev. James Cumming, M.A., and John Thomas Graves, Esq., M.A.

James Scott Bowerbank, Esq., and Charles Towneley, Esq., were balloted for and duly elected Fellows of the Society.

The following papers were read, viz:—

1. Postscript to a paper "On the Action of the Rays of the Solar Spectrum on Vegetable Colours." By Sir John Frederick William Herschel, Bart, F.R.S., &c.

An account is here given of some additional facts illustrative of the singular properties of iron as a photographic ingredient, and also of some highly interesting photographic processes dependent on those properties, which the favourable weather of the summer has enabled him to discover. The author also describes a better method of fixing the picture, in the process which he has denominated the *Chrysotype*, than that which he had specified in the latter part of his paper. In this new method the hydriodate is substituted for the hydrobromate of potass; and the author finds it perfectly effectual; pictures fixed by it not having suffered in the smallest degree, either from long exposure to sunshine or from keeping.

He next considers the class of processes in which cyanogen, in its combinations with iron, performs a leading part, and in which the resulting pictures are blue; processes which he designates by the generic term *Cyanotype*. Their varieties appear to be innumerable, but one is particularly noticed, namely, that of simply passing over the ammonio-citrated paper, on which a latent picture has been impressed, very sparingly and evenly, a wash of the solution of the common yellow ferrocyanate of potass. As soon as the liquid is applied the negative picture vanishes, and is replaced, by very slow degrees, by a positive one, of a violet-blue colour on a greenish-yellow ground, which, at a certain moment, possesses a high degree

of sharpness, and singular beauty and delicacy of tint. From his further researches on this subject he deduces the following conclusions: first, that it is the heat of the rays, not their light, which operates the change; secondly, that this heat possesses a peculiar chemical quality, which is not possessed by the purely calorific rays outside of the visible spectrum, though far more intense; and thirdly, that the heat radiated from obscurely hot iron abounds especially in rays analogous to those of the region of the spectrum above described.

The author then describes the photographic properties he has discovered to belong to mercury, a metal which he finds to possess, in an eminent degree, direct photographic susceptibility.

2. "Observations de la variation de la déclinaison et intensité horizontale magnétiques observées à Milan pendant vingt-quatre heures consécutives, le 22 et 23 Juin, le 20 et 21 Juillet, le 26 et 27 d'Aout, le 21 et 22 Septembre, et le 19 et 20 Octobre, 1842," rapportées par Robert Strambrecchi, premier élève adjoint.

A letter was also read from Sir John F. W. Herschel on the subject of Photography, addressed to S. Hunter Christie, Esq., Sec. R.S.

November 24, 1842.

FRANCIS BAILY, Esq., Vice-President, in the Chair.

The following papers were read, viz:—

1. "On certain improvements on Photographic Processes described in a former communication." By Sir John Frederick William Herschel, Bart, K.H., F.R.S., &c., in a letter to Samuel Hunter Christie, Esq., Sec. R.S. Communicated by Mr. Christie.

The present memoir, which is a sequel to the last by the same author, is accompanied by a series of photographic impressions illustrative of the chrysotype, cyanotype, and other processes formerly described by him. Some improvements which he has introduced into these processes are given, together with a few remarks on some other points treated of in the former paper, in relation to the influence of *thermic rays* as distinct from *calorific rays*; the former being rays, which in the spectrum accompany the red and orange rays, which are also copiously emitted by heated bodies short of redness, and which are distinguished from those of light by being invisible. The author thinks they may be regarded as bearing the same relation to the calorific spectrum which the photographic rays do to the luminous one, and would propose to designate them by the term *parathermic rays*. He conceives that these may be the rays which are active in producing those singular molecular affections determining the precipitation of vapours in the experiments of Messrs. Draper, Moser, and Hunt, and which will probably lead to important discoveries as to the intimate nature of those forces, resident on

the surfaces of bodies, to which M. Dutrochet has given the name of *epipolic forces*.

2. "Boring Register, Bow Island, South Pacific." By Captain Edward Belcher, R.N., communicated by Captain Beaufort, R.N., F.R.S.

The results of the boring operations carried on in this island are here given, as well as the register of the daily proceedings, under the particular superintendence of Mr. Thomas Pass, acting master of H.M.S. Sulphur. The depth reached was 45 feet, when the augur broke, and no further progress could be made.

November 30, 1842.

At the Anniversary Meeting,

The MARQUIS OF NORTHAMPTON, President, in the Chair.

John Thomas Graves, Esq., M.A., on the part of the Auditors of the Treasurer's Accounts, reported, that the total receipts during the last year, inclusive of a balance of 609*l.* 2*s.* 8*d.*, carried from the account of the preceding year, amounted to 3959*l.* 0*s.* 10*d.*; and that the total payments in the same period amounted to 2813*l.* 17*s.* 5*d.*, leaving a balance in the hands of the Treasurer of 1145*l.* 3*s.* 5*d.*

The thanks of the Meeting were given to the Auditors for the trouble they have taken in examining the Treasurer's accounts.

The thanks of the Meeting were voted to the Treasurer.

The Secretary read the following list of deceased Fellows of the Royal Society since the last Anniversary in 1841; of those ejected, and of Fellows admitted into the Royal Society since the last Anniversary.

List of Fellows of the Royal Society deceased since the last Anniversary (1841).

On the Home List.

Sir William Be..tty, Knt., M.D.
Sir Charles Bell, K.H.
Thomas Blizard, Esq.
Lt.-Col. Sir Alex. Burnes, Knt.
Sir William Burroughs, Bart.
Richard Hart Davis, Esq.
Joseph Delafield, Esq.
John Dickenson, Esq.
The Right Hon. Sir William Garrow, Knt.
Lord Francis Gray.
Francis George Hare, Esq.
Henry Hennell, Esq.
Sir Henry Hugh Hoare, Bart.
James Ivory, Esq., K.H., M.A.
Joseph Jekyll, Esq. M.A.
Aylmer Bourke Lambert, Esq.
The Earl of Macclesfield.
The Earl of Munster.
The Duke of Norfolk.
John Gage Rokewode, Esq.
Samuel Seaward, Esq.
Henry Harper Spry, Esq.
Lord Vivian.
Lieut. J. R. Wellstead, I.N.
John Yelloly, M.D.

Ejected.
William John Bankes, Esq.

List of Admissions into the Royal Society since the last Anniversary (1841).

On the Home List.

Capt. William Allen, R.N.
Edw. Hodges Baily, Esq., R.A.
John Joseph Bennett, Esq.
James Scott Bowerbank, Esq.
Rob. Edwards Broughton, Esq.
Thomas Chapman, Esq.
Rev. Henry Christmas, M.A.
Ardaseer Cursetgee, Esq.
William Fishburn Donkin, Esq.
Geo. Hunsley Fielding, M.D.
John Jesse, Esq.
Cuthbert William Johnson, Esq.
The Earl of Lovelace.
Major Gen. Wm. Morison, C.B.
Lieut. Tho. J. Newbold, E.I.C.S.
Samuel Peace Pratt, Esq.
Lieut. Chas. Jas. B. Riddell, R.A.
Capt. Owen Stanley, R.N.
Thomas Glanville Taylor, Esq.
Joseph Toynbee, Esq.

On the Foreign List.

His Majesty the King of Prussia.
Henry Frederic Link.
Dr. G. S. Ohm.
Jean Victor Poncelet.
Henry Rose.

The President then addressed the meeting as follows:

Gentlemen,

I must commence my address to you by the expression of my regret that my absence from England at this period of the last year prevented my being then able to meet you at your Anniversary. The gratitude which it has behoved me to intimate to my Council on former occasions for their assistance in the discharge of my presidential duties, it is more than ever necessary for me now to feel, as it was that assistance that rendered my absence no real detriment to the Society.

During that absence, an event took place to which I am bound to refer,—I allude to the visit to this city of the sovereign of another country at the time of the auspicious baptism of His Royal Highness the Prince of Wales. His Prussian Majesty was pleased to join our Society. At this I heartily rejoice, as I believe it to be a happy omen for mankind when those who are placed in exalted situations show their sympathy with scientific pursuits. I congratulate the Prussian nation, that her sovereign has taken so early an opportunity of countenancing science, and of declaring his opinion that the natural philosopher is a friend to good government, to order, and to civilization.

The pleasure experienced by you on this occasion was enhanced by the presence within these walls of Baron Humboldt, who accompanied his Majesty. It is very seldom that we can expect to see among us any of our Foreign Associates. It was therefore doubly gratifying to receive, together with his sovereign, the distinguished philosopher who had travelled over so large a portion of the globe in the pursuit of every branch of knowledge.

Since I last addressed you, two years ago, a great degree of success has attended the expedition of Captain Ross to the Antarctic Region. I congratulate you, Gentlemen, on the results already derived from an expedition which originated in a joint application to Government from your Council and the British Association. I rejoice that a British officer has had the honour, not only of making most important scientific researches, but also of approaching much nearer to the Southern Pole than any one had done before him, and of discovering a new Iceland and a new Hecla, more gigantic than the arctic volcano.

With respect to the magnetic observatories, I have the gratification of informing you that they are to be continued for three more years, in hopes of making the information to be obtained from them more extensive and more accurate. The consent to this continuance was granted by Sir Robert Peel: a continuance of the scientific measure of one minister by the statesman who had superseded and succeeded him. This is a gratifying circumstance, as proving that, as we hope and believe that British patriotism belongs to all parties, so the love of science also belongs to all, or rather that in scientific pursuits there is no party feeling and no party jealousy. I must add, that on the present occasion, the application of the Council of the Royal Society was seconded by M. Brunow, the ambassador of the Emperor of Russia; thus showing that nations are ready to testify that any great acquisition of physical knowledge is a common object to the whole human race.

The hopes that the Expedition to the Niger might be productive of important additions to our stores of science, as well as great results to the highest interests of humanity, have been unhappily in a great measure disappointed. At the same time the hopes of the scientific naturalist have not been entirely vain, for I am informed by Mr. Gray that many new species of birds and other animals have been brought to England from Fernando Po and the mouth of the Niger.

Your Council, Gentlemen, have taken into their consideration the great importance that microscopical researches have always possessed, and the still greater influence upon science that they are now beginning to exercise, in the hands of Mr. Owen and others, as well as the extraordinary perfection to which the instrument itself is now brought. They have come to the conclusion that it is highly expedient that we should ourselves possess the means of repeating and verifying the experiments brought before our notice, as well as instituting new branches of inquiry. We have therefore thought it expedient, by summoning competition to our aid, to endeavour to

obtain one of the best microscopes that can be constructed. Indeed we feel sure, that, independently of the liberal price that we have offered, there is no optician who would not feel highly gratified on seeing within these walls an instrument constructed by him.

The room, Gentlemen, in which we are met, has had some changes made in the pictures which adorn its walls. In consequence of these changes you will see, in addition to those portraits to which you are accustomed, the likeness of one of the most distinguished of our body; of one who was equally eminent in natural philosophy and in archæology. Our posterity, Gentlemen, will probably hereafter be at a loss whether to admire Dr. Young most in his pursuits of natural knowledge, or in his discovery of the key to the greatest mystery of bygone ages,—the hieroglyphical writing of the Egyptians.

You will not be less pleased to see another portrait of a venerable philosopher still spared to us—of that great and original chemist, Dr. Dalton.

I have to congratulate you also on the possession of the bust of a lady whose acquirements are an honour to her sex and to her country; and I feel sure that the likeness of Mrs. Somerville, from the hand of our lamented Chantrey, will ever be highly prized by the Royal Society.

In addition to these ornaments to our Apartments, since I addressed you in our Anniversary Meeting of 1840, I must not pass over the portrait of Mr. Dollond, to whom the astronomer is so much indebted for his improvement in the art of constructing telescopes; and I should be wholly inexcusable if I omitted the valuable picture given to us by Mr. Vignolles, and representing the prince of English science, the immortal Sir Isaac Newton.

I am happy to state that the Royal Society has not, during the past year, had to lament the death of any one of her Foreign Members. We could not reasonably hope that such should be the case among her British Fellows. I shall now, Gentlemen, conclude, as usual, by a short account of some of the more remarkable men, whether for scientific research, or for public services, whom the Royal Society has had the misfortune to lose since last November.

Among the deceased Fellows of the present year, we have to lament the loss of one of the most eminent surgeons and physiologists of our times—one whose investigations and discoveries have shed a new light on that most intricate part of the human organization—the Nervous System.

Sir Charles Bell, K.H., F.R.S. L. and E., &c., the youngest son of the Rev. W. Bell, of the episcopal church of Scotland, was born at Edinburgh in the year 1778. While a mere youth, he was instructed in the elements of anatomical science by his brother Mr. John Bell (himself a distinguished surgeon and anatomist), and at a very early period he published the first part of "Plates of Dissections;" a work alike remarkable for the fidelity of the anatomical

details, and the spirited style of the illustrations from the pencil of the author.

In 1799, Mr. Charles Bell was admitted a member of the Royal College of Surgeons of Edinburgh, and soon afterwards was appointed one of the surgeons of the Royal Infirmary in that city, where he acquired a high reputation as a skilful and dexterous operator.

In 1806, he removed to London; and by his own unaided exertions, established himself as a lecturer on Anatomy and Surgery. He was subsequently associated with Mr. Wilson in the celebrated anatomical school of Great Windmill Street, and speedily became one of the most popular and effective lecturers in the surgical schools of London; although at that period, Cline, Cooper, Abernethy, and other eminent men, were in the zenith of their fame as professional teachers.

He was elected Surgeon to the Middlesex Hospital in 1812.

A few years afterwards he was appointed Professor of Anatomy and Surgery to the Royal College of Surgeons of London, in which capacity he delivered a series of lectures, which excited in an extraordinary degree the interest and attention of the profession, the theatre of the College being crowded to the conclusion of the course.

Immediately after the battle of Waterloo, Mr. Charles Bell, with that humanity and zeal for the pursuit of professional knowledge which marked his character, proceeded to Brussels, and tendered his assistance to the wounded soldiers in the hospitals of that city; and after his arrival he was incessantly engaged for three successive days and nights in the operations and dressings of upwards of 300 cases.

In 1826, Mr. Charles Bell was admitted a Fellow of the Royal Society.

On the institution of the London University College, in 1828, Mr. Charles Bell was chosen Principal of the Medical School; and he delivered the opening lecture in that department of the College, and also a course of lectures on Physiology.

On the accession of William IV. to the throne, Mr. Charles Bell, together with a limited number of other men of distinguished scientific attainments, received the honour of knighthood.

A "Treatise on Animal Mechanics," composed by Sir Charles Bell for the Society for the Diffusion of Useful Knowledge, being the substance of some of the lectures which he had delivered before the College of Surgeons, contained so powerful and lucid an exposition of the proofs of creative design, as exemplified in the structure of the human frame, that our late President, Mr. Davies Gilbert, was led to select the author as one of the Bridgewater Essayists. "An Essay on the Hand, its mechanism and its vital endowments as evincing design," is the title of the admirable volume which Sir Charles Bell, in accordance with the provisions of the appointment, contributed to those celebrated essays.

Sir Charles Bell, in conjunction with Lord Chancellor Brougham,

also published "Illustrations of Dr. Paley's Evidences of Natural Theology."

In 1836, he accepted the Chair of Surgery in the University of Edinburgh, to which he was invited by the unsolicited and unanimous vote of the patrons of that institution; and he left London to place himself at the head of the profession in his native city. In this new sphere of usefulness he continued to pursue with undiminished ardour the cultivation of surgery and physiology until his death, which took place on the 29th of April, 1842, at Hallow Park, in Worcestershire.

With this brief sketch of the professional career of Sir Charles Bell, I proceed to notice those original and important investigations into the nature and functions of the nervous system, upon which his high reputation as a physiologist is based, which entitle him to be ranked among the most distinguished Fellows of this Society, and for which he was deservedly awarded the first Royal Medal we had to bestow.

The earliest contribution of Sir Charles Bell to our Transactions was in 1821, "On the Nerves, giving an account of some experiments on their structure and functions, which lead to a new arrangement of the system." This was followed by other essays on the same subject, which were severally published in the Philosophical Transactions for 1822, 1823, 1826, 1829, 1832, 1834, 1835, and 1840.

In the last communication, entitled "On the Nervous System," the author gives a condensed view of his investigations and discoveries, the result of more than thirty years of indefatigable labour and research.

As long since as 1806, in the first edition of his beautiful work "On the Anatomy of Expression in Painting," we perceive the germ of those original views of the nervous system, which it was the labour of his life to elucidate and establish. "If," he observes, "we had but a perfect knowledge of the functions of the nerves, they would on all occasions inform us of the cause of those actions which now appear to us so inexplicable." And here I may observe, that the drawings which illustrate this work are in the first style of art, and show, that had the author chosen painting as a profession, he would have attained a distinguished rank as an artist.

In 1811, in a small work entitled "An Idea of a new Anatomy of the Brain, submitted for the observation of his friends, by Charles Bell, F.R.S.E," he distinctly enunciates those original opinions, which, modified and extended by subsequent investigations and discoveries, have led to those enlarged and philosophical views of the phenomena of the nervous system, which have so largely contributed to the advancement of physiological science.

In short, whatever we may owe to the genius and labours of other men in this field of research, the discovery of the grand fundamental principle upon which a correct knowledge of the functions of the nervous system depends, is unquestionably due to Sir Charles Bell.

He was the first to ascertain, not by accident, but by careful and laborious dissections and experiments, and by a cautious induction from the phenomena which his talents and unwearying industry enabled him to develope, that "the nerves which we trace in the body are not single nerves possessing different powers, but are bundles of different nerves whose filaments are enclosed in one common sheath, but which are as distinct in function as they are in origin; that they depend for their specific attributes on the nervous masses to which they are severally attached; that the spinal nerves arising from the lateral and anterior columns of the medulla spinalis convey the power of motion, while the nerves arising from the posterior strands communicate the faculty of sensation to the several parts of the body to which they are distributed." The nerves which arise from the middle and upper columns of the spinal marrow, Sir Charles conceived to be designed for the act of respiration; and these he termed the "*system of respiratory nerves.*"

Having thus established the principle by anatomy and experiment, that the nerves possess distinct functions in correspondence with their origin from different parts of the brain and spinal marrow, Sir Charles Bell followed up his inquiries by collecting such pathological facts as served to illustrate and confirm the opinions he had advanced; and our Transactions are enriched by numerous memoirs relating to this most important subject. His essays on the nerves of the face in health and disease are of the deepest interest, and their practical value cannot be too highly estimated. In fact, the great advancement which has been made of late years in our knowledge of the nature and treatment of the diseases of the nervous system, is mainly attributable to the labours and discoveries of Sir Charles Bell*.

* A list of Sir Charles Bell's contributions to the Philosophical Transactions is subjoined.

1. On the Nerves; giving an Account of some Experiments on their Structure and Functions, which lead to a new arrangement of the System. (Phil. Trans. 1821, p. 398.)
2. Of the Nerves which associate the Muscles of the Chest, in the actions of Breathing, Speaking and Expression; being a continuation of the paper on the Structure and Functions of the Nerves. (Ibid. 1822, p. 284.)
3. On the Motions of the Eye, in illustration of the Uses of the Muscles and Nerves of the Orbit. (Ibid. 1823, p. 166.)
4. Second part of the paper on the Nerves of the Orbit. (Ibid. 1823, p. 289.)
5. On the Nervous Circle which connects the voluntary Muscles with the Brain. (Ibid. 1826, Part II. p. 163.)
6. On the Nerves of the Face; being a second paper on that subject. (Ibid. 1829, p. 317.)
7. Of the Organs of the Human Voice. (Ibid. 1832, p. 299.)
8. On the Functions of some parts of the Brain, and on the relations between the Brain and Nerves of Motion and Sensation. (Ibid. 1834, p. 471.)
9. Continuation of a paper on the Relations between the Nerves of Motion and Sensation, and the Brain; more particularly on the Structure of the Medulla oblongata and the Spinal Marrow. (Ibid. 1835, p. 255.)
10. On the Nervous System. (Ibid. 1840, p. 245.)

In private life this eminent man was distinguished by the suavity and simplicity of his manners, by his elegant tastes, and domestic virtues*.

Mr. James Ivory was the son of Mr. James Ivory, watchmaker in Dundee, and was born in that town in the year 1765. He received his elementary education at the public schools of Dundee, and in the year 1779, was sent to the University of St. Andrews, where, in the period of four years, he went through a course of Languages, Science and Philosophy, entitling him to the Degree of Master of Arts, which was afterwards conferred on him. While at this University he was distinguished for his attainments in Mathematics, to the study of which branch of science he had, even at this early period of his life, particularly applied himself, under the able instruction of the Rev. John West, at that time assistant to the Professor in the University. It reflects equal credit upon the pupil and the instructor, that for this gentleman Mr. Ivory ever after entertained the highest regard.

Being intended for the Church of Scotland, he now commenced his studies in theology, and in the prosecution of them remained two years at St. Andrews, after the completion of his course of Philosophy. He then removed to the University of Edinburgh; and it is not a little remarkable that he should have done so with Leslie, who had been his fellow-student at St. Andrews. At Edinburgh, he received his third year's theological instruction, necessary, by the regulations of the Scottish church, to qualify him for admission as a clergyman. His studies in divinity were not, however, prosecuted farther; for immediately on leaving the University of Edinburgh, he was, in 1786, appointed assistant-teacher in an academy then instituted in his native town of Dundee, for the purpose of instruction in mathematics and natural philosophy. Having remained in this situation three years, he entered upon a totally different career, becoming a partner in, and the manager of a Flax-spinning Company, which had its mills at Douglastown in Forfarshire, and which assumed the name of James Ivory and Company.

Though now engaged in commercial and manufacturing pursuits, Mr. Ivory still devoted every moment of leisure to his favourite object, the prosecution of mathematical investigations. Living in a secluded part of the country, he was debarred from the advantages of access to libraries and the society of men of science, which a more favoured locality might have afforded him; but this obstacle to the enlargement of his knowledge was overcome by the force of his genius and his powers of application. With a sound knowledge of the geometry of the ancient and of the modern mathematics of his own country, he had already possessed himself of the methods and discoveries of the continental mathematicians, at that time almost wholly unknown in Britain; and he early led the way in that path which he afterwards followed with unrivalled success.

* An excellent account of the life and writings of Sir Charles Bell will be found in Pettigrew's Medical Portrait Gallery, vol. iii.

His earliest memoir, read before the Royal Society of Edinburgh, on the 7th of November 1796, and published in its Transactions, shows, not only that at this time he was well acquainted with the works, and possessed the methods of the most celebrated of the continental writers, but that he could advance independently in the track which they had discovered and so successfully pursued. This memoir, entitled "A New Series for the Rectification of the Ellipse, together with some Observations on the Evolution of the Formula $(a^2 + b^2 - 2ab\cos\phi)^n$," besides displaying considerable analytical skill in the accomplishment of its immediate object, shows that the solution of the highest class of physical problems had already engaged the author's attention.

Two other memoirs, communicated by Mr. Ivory to the same Society, one in 1799, "A New Method of resolving Cubic Equations," and the other in 1802, "A New and Universal Solution of Kepler's Problem," both indicate great originality of thought and powers of investigation. The approximation which he gives in the latter memoir for the determination of the excentric anomaly is remarkable for its simplicity, universality, and accuracy.

At this period, Mr. Ivory was in correspondence with Professor Playfair, Mr. Leslie (afterwards Sir John Leslie), Mr. Wallace and Mr. Brougham (now Lord Brougham), and with these eminent persons his intercourse was ever after continued until interrupted by the death of one of the parties. To the well-founded recommendation of Lord Brougham he was indebted for the grant of a pension of £300 per annum, in 1831, by King William IV.

Released from the anxieties of mercantile speculations by the dissolution of the company of which he had been the manager, he, in 1804, applied for, and immediately obtained, one of the Mathematical Professorships in the Royal Military College at Marlow (afterwards removed to Sandhurst). During the time that he was connected with this institution, he acquired the esteem and regard of the authorities of the College, of his colleagues, and of his pupils. In the discharge of his public duty he appears to have been altogether exemplary; and he was universally considered to be one of the best and most successful instructors that had ever been connected with the College.

He now became better known in the scientific world, and while he discharged the important duties of his Professorship to the advantage of the College and the advancement of its character, he communicated to the public many important memoirs on various scientific subjects, which appeared in the Philosophical Transactions, in Leybourn's Mathematical Repository, Maseres's Scriptores Logarithmici, and the Supplement to the sixth edition of the Encyclopædia Britannica.

About the year 1816, his health began to give way under the confinement consequent upon close application to his professorial duties, and devoted attachment to scientific inquiry; and he was compelled by bad health to resign his Professorship. The estimation in which he was held by the authorities of the College cannot

be more conclusively shown than by the fact, that, when disabled by ill health from performing his arduous duties, the Governor and the Commissioners of the College recommended and procured the retiring pension to be given to him, some years before he had completed the period of service which the regulations of the War Office at that time required. He now took up his residence in London, and in this metropolis or its environs he spent the remainder of his days, living always in great retirement.

Disengaged from professional duties, though still suffering in health, he now devoted his whole time and all the energies of his powerful mind to the investigation and elucidation of various mathematical problems of the highest order; and the result of his inquiries were given to the world in numerous elaborate memoirs, many of the most important of which, it is gratifying to reflect, adorn the volumes of our Transactions. It is no less gratifying to feel that this Society was at the time fully alive to the value of these communications, by awarding to their author, on successive occasions, the highest honours in its power to bestow. In 1814, Mr. Ivory received the Copley Medal "for his various Mathematical communications printed in the Philosophical Transactions."

In 1826, one of the Royal Medals was awarded to him "for his Paper on Astronomical Refractions, published in the Philosophical Transactions for the year 1823, and his other valuable papers on Mathematical subjects." And again in 1839, he received one of the Royal Medals "for his Paper on the Theory of Astronomical Refractions, published in the Philosophical Transactions for 1838," which paper was the Bakerian Lecture for the year.

If Mr. Ivory's rank among the mathematicians of his age could be assigned independently of his communications to the Royal Society, he must still occupy a distinguished place, not only among those of his own country, but of Europe. It was, however, by the communications with which he has enriched our Transactions, that he gained the great scientific reputation which he enjoyed, and it is with them also that we are more immediately concerned.

These papers may be classed under eight different heads; for although several of them are closely related in regard to their physical objects, yet the nature of the mathematics employed in them is so different, that we should do injustice to his reputation if we arranged them under one head.

The first of these is the investigation of the attraction of homogeneous ellipsoids of the second order upon points situated within or without them, printed in the Transactions for 1809. This paper contained the celebrated theorem by which the attraction of an ellipsoid on a point exterior to it, is made to depend upon the attraction of another ellipsoid upon another point interior to it; the latter investigation being, as is well known, comparatively easy. The solution of the more difficult case had been reduced to a form nearly equivalent to this by Laplace, but his process was troublesome; that by Mr. Ivory is remarkably simple and elegant. Although this transformation constitutes the most valuable part of the

paper, it would be wrong to omit to state that the developments which it contains, on the investigation of the attraction in the simpler case, are highly ingenious, and exhibit a perfect command of analysis.

The second subject is the criticism upon the method used by Laplace in the third book of the 'Mécanique Céleste,' for the computation of the attraction of spheroids of any form differing little from spheres, and the substitution of a method purely analytical for some of Laplace's operations which are founded on a geometrical consideration. The papers which contain Mr. Ivory's remarks on these subjects are two papers and an appendix in the volume for 1812, and one in that for 1822. The remarks on Laplace's theory adverted to two points. One of these was the faultiness of his reasoning as relates to the evanescence of the attraction of the particles included between the spheroidal and a spherical surface when the attracted particle was brought very near to the surface. The other was a limitation of the generality of Laplace's assumption for the form of the function expressing the distance between the sphere and the spheroid, to a rational function of the coordinates of each point. With regard to the first of these subjects, it seems impossible to deny that Laplace had, in the greater part of his investigation, left the interpretation of his suppositions in some obscurity; and Mr. Ivory has, with remarkable acuteness and analytical skill, exposed the defects of Laplace's investigation on *his* interpretation of the suppositions. Yet we must observe that the limitation expressed by Laplace ("supposons de plus que la sphère touche le sphéroide, &c.") appears to be entirely overlooked by Mr. Ivory, and that this limitation, when its effects are fairly examined, completely removes the objection. As to the second subject, it is, we believe, allowed by Mr. Ivory himself, that there is no failure in the investigation if the function for the distance between the sphere and the spheroid, though not explicitly rational, admits of being expanded in a converging series whose terms are rational; the only case undoubtedly that can ever occur in physical application. The analytical process which Mr. Ivory substituted for a part of Laplace's is extremely beautiful.

To show the estimation in which Mr. Ivory's talents and labours were held by Laplace himself, we may here quote a remark from Sir Humphry Davy's Address in 1826, on the award of the Royal Medal to Mr. Ivory. "I cannot pretend," says our, then, distinguished President, "to give any idea of the mathematical resources displayed in the problems, and which even the most accomplished geometer could not render intelligible by words alone; but I can speak of the testimony given by M. de Laplace himself in their favour. That illustrious person, in a conversation which I had with him some time ago on Mr. Ivory's first four communications, spoke in the highest terms of the manner in which he had treated his subject; one, he said, of the greatest delicacy and difficulty, requiring no ordinary share of profound mathematical knowledge, and no common degree of industry and sagacity in the application of it."

The investigations to which we have just alluded are those upon

which Mr. Ivory's European reputation as a consummate mathematician was principally founded; and deservedly so. It is no small praise, even at the present time, to assert of any mathematician, that he thoroughly understands the remarkable investigations of Laplace applying to the attractions of spheroids; and it would be still greater to assert that he is able to substitute a new, clear, and elegant process, in place of one portion which seems doubtful and indirect. But at the time when these papers were written (1808 and 1811) the merit was vastly greater than it would be now. Very few English mathematicians could then read with ease an investigation written in the notation of the differential calculus; scarcely any could understand a process of partial differentials; and probably not another person in the kingdom besides Mr. Ivory had read that part of the Mécanique Céleste. In acknowledging that Mr. Ivory most justly earned the reputation which he acquired (and our remarks above, detracting from the necessity of his criticism, do not in the least detract from its singular skill and command of mathematics), we must not omit also to acknowledge, that to his example we owe, in no inconsiderable degree, that direction of mathematical study which has enabled England, at last, to compete in the field of mathematical science with the other nations of Europe, to which she was during a long interval inferior.

The third subject is the investigation of the orbits of comets. Mr. Ivory's method, printed in the Transactions for 1814, is founded on the supposition that the orbit is a parabola, and it tests the trial-assumption of the distance of the comet by the well-known expression for the time depending on two radii vectores and the chord joining them. Although the analysis is elegant, there is not much of originality in this process.

The fourth subject is the investigation of atmospheric refraction. The papers relating to this are contained in the volumes for 1823 and 1838. The former of these proceeds solely on the supposition that the temperature of the air (as entering into the factor which connects the density with the elasticity) decreases uniformly for uniform increase of elevation. The investigation is not remarkably different from those of other writers on the theory of astronomical refractions. The latter contains the effects of adding to the expression for the density of the air resulting from the first supposition, a series of terms following a peculiar law which make the expression perfectly general for all laws of temperature, and which at the same time offer great facilities for mathematical treatment. The whole investigation deserves particular notice as a beautiful instance of mathematical skill. Considerable labour was also bestowed by Mr. Ivory, in these papers, on the ascertaining, from the best accredited experiments, of the values of the constants which enter into different parts of the formulæ.

A fifth subject was treated by Mr. Ivory in elaborate papers in our Transactions for 1824, 1831, 1834, and in a portion of a paper in the Transactions for 1839. The object, in these papers, was to show that the method in which the equilibrium of fluid bodies has

been treated by mathematicians is defective, one additional equation being, in Mr. Ivory's views, logically necessary, although he allows that its introduction produces no change of results in the case which he has investigated at great length, namely, that of a homogeneous fluid. The Royal Society have conceived that the acknowledged uncommon abilities of Mr. Ivory, and the great attention which he had given to this particular subject, made it almost imperative on them to afford every facility which their Transactions could give to the elucidation of his views, more especially as the logical foundation of the theory had scarcely been canvassed to the same extent as that of many other physico-mathematical theories. At the same time they think it necessary, in adverting to this particular theory, to remark, that no other mathematician has agreed with Mr. Ivory in the necessity of his new equation.

While Mr. Ivory still had the subject of the equilibrium of fluids in his consideration, the very remarkable discovery was announced, by MM. Jacobi and Liousville, that it is theoretically possible that a homogeneous ellipsoid with three unequal axes, revolving about one of these axes, may be in equilibrium. In a paper in the Transactions for 1838, Mr. Ivory has with great elegance demonstrated this theorem, and has given, with greater detail than its authors had entered on, several statements regarding the limitations of the proportions of the axes. This may be regarded as the sixth subject.

A seventh subject, the Theory of Perturbations, was treated in papers in the Transactions for 1832 and 1833. The first of these is a treatment of the theory of the variation of the elements, giving no new result, but simplified, in the author's opinion, by the introduction of the area described upon the planet's moving orbit. The second relates merely to the expansion of the perturbing function, in which, by departing in some degree from the usual process, Mr. Ivory conceived that he had given greater facilities for the developments to the higher order of excentricities and inclinations.

An eighth subject, which we have reserved for the last, as containing nothing of a physical character, is the Theory of Elliptic Transcendents, treated in the Transactions for 1831. We are not aware that anything important is added to the theory in this paper, although a new form is given to some of the demonstrations.

The great scientific reputation which Mr. Ivory had established by these and other memoirs not communicated to the Royal Society ensured his election into this Society in 1815, and into many of the other Scientific Societies of this country and of the Continent. He was an Honorary Fellow of the Royal Society of Edinburgh, an Honorary Member of the Royal Irish Academy, and of the Cambridge Philosophical Society; Corresponding Member of the Royal Academy of Sciences of the Institute of France, of the Royal Academy of Sciences of Berlin, and of the Royal Society of Göttingen.

In 1831, the Hanoverian Guelphic Order of Knighthood was conferred on him by King William IV., and it was intimated that he might also receive the British Knighthood, but this he declined, as the title would have been inconsistent with his circumstances. He

had, however, as has already been stated, a pension of £300 per annum subsequently conferred on him by His Majesty. In 1839, the University of St. Andrews conferred on him the Degree of Doctor of Laws.

Although his health had been early impaired by his close application to scientific investigation, he never allowed himself to be unoccupied, but was constantly engaged in his researches to the period of his last illness. In the end of last year his health became seriously impaired, and after an illness of several months, but retaining his faculties to the last, he died on the 21st of September of the present year, aged 77. He was never married*.

Aylmer Bourke Lambert, Esq., was born at Bath on the 2nd of February, 1761. He was the son of Edmund Lambert, Esq., of Boyton House, near Heytesbury, and inherited the name of Bourke from his mother, who was the daughter of Viscount Mayo. He

* The contributions of Mr. Ivory to the Philosophical Transactions are the following:—

1. On the Attractions of Homogeneous Ellipsoids. (Phil. Trans. 1809, p. 345.)
2. On the Grounds of the Method which Laplace has given in the second chapter of the third book of his Mécanique Céleste for computing the Attractions of Spheroids of every description. (Ibid. 1812, p. 1.)
3. On the Attractions of an extensive class of Spheroids. (Ibid. 1812, p. 46.)
4. A New Method of deducing a first Approximation to the Orbit of a Comet from three Geocentric Observations. (Ibid. 1814, p. 121.)
5. On the Expansion in a series of the Attraction of a Spheroid. (Ibid. 1822, p. 99.)
6. On the Astronomical Refractions. (Ibid. 1823, p. 409.)
7. On the figure requisite to maintain the Equilibrium of a Homogeneous Fluid Mass that revolves upon an Axis. (Ibid. 1824, p. 85.)
8. On the Equilibrium of Fluids, and the Figure of a Homogeneous Planet in a Fluid State. (Ibid. 1831, p. 109.)
9. On the Theory of the Elliptic Transcendents. (Ibid. 1831, p. 349.)
10. On the Theory of the Perturbations of the Planets. (Ibid. 1832, p. 195.)
11. On the Development of the Disturbing Function, upon which depend the inequalities of the Motions of the Planets, caused by their mutual Attraction. (Ibid. 1833, p. 559.)
12. On the Equilibrium of a Mass of Homogeneous Fluid at liberty. (Ibid. 1834, p. 491.)
13. Of such Ellipsoids consisting of homogeneous matter as are capable of having the resultant of the attraction of the mass upon a particle in the surface, and a centrifugal force caused by revolving about one of the axes, made perpendicular to the surface. (Ibid. 1838, p. 57.)
14. On the Theory of the Astronomical Refractions. (Ibid. 1838, p. 169.)
15. On the Condition of Equilibrium of an Incompressible Fluid, the particles of which are acted upon by Accelerating Forces. (Ibid. 1839, p. 243.)
16. Note of Mr. Ivory, relating to the correcting of an error in a paper printed in the 'Philosophical Transactions' for 1838, pp. 57, &c. (Ibid. 1839, p. 265.)

died at Kew on the 10th of January of the present year, having nearly completed his 81st year. His name appears among the original members of the Linnean Society, and for nearly fifty years he was one of its Vice-Presidents. He became a Fellow of the Royal Society in 1791, and consequently had belonged to it for more than half a century. He was an eminent botanist, and formed a very extensive herbarium, and was at all times anxious to give information to those attached to the same pursuit. He was the author of many papers in the Linnean Transactions, but his most considerable works were two separate publications. One on the genus Cinchona was given to the world in 1797. The other was a description of the genus Pinus,—a truly magnificent work, which originally came before the public in two vols. folio in the year 1803, to which a third vol. was added in 1834.

He married Catherine, daughter of Richard Bowater, Esq., whom he survived some years, and by whom he left no family. He did not furnish any papers to the Transactions of the Royal Society.

Sir Alexander Burnes is undoubtedly one of those whose death will be most lamented by a country that was proud of his eminent qualities, and grateful for his zealous services.

The name of Burnes was already distinguished in the northern portion of our island. It has received a new lustre from one well worthy of his descent from the same family as Scotland's celebrated poet. Sir Alexander was born at Montrose on the 16th of May, 1805. The same town had the honour of his education. He entered on his career of active service as a cadet of the Bombay army in the year 1821. At the early age of twenty he was appointed Persian interpreter to a force of 8000 men assembled under Colonel Napier for the invasion of Sinde. The following year he was appointed Deputy-Assistant-Quarter-Master-General.

He received, in 1827, the thanks of Government for an elaborate statistical report; and the following year, the Government showed itself equally satisfied with a valuable memoir of the eastern mouth of the Indus. This was succeeded by a valuable supplement.

In 1828, Lieut. Burnes applied for permission to visit the country between the Indus and Marwar; but though this plan was approved of by Sir John Malcolm and Sir Henry Pottinger, its execution was delayed. Burnes was appointed the same year Assistant-Quarter-Master-General, and received orders from the Court of Directors to complete a map of Cutch already commenced by him. Shortly after, he was appointed assistant to the political agent in Cutch, and published in the Transactions of the Royal Geographical Society an account of his survey of that country.

In 1830, he was sent with a present of horses from the King of England to Runjeet Singh. He visited Hydrabad, Lahore, Soodiana, and proceeded to Simla to receive further instructions from Lord W. Bentinck.

After travelling into Central Asia, he revisited Bombay in 1833; thence he received orders to return home with his own despatches,

and was received most cordially in England. His travels were now published, and met a most hearty welcome. They were immediately translated into the French and German languages, the best proof of their merit and importance being appreciated in other countries besides his own. He was warmly welcomed by the Royal Asiatic Society; and the French and English Geographical Societies bestowed on him their respective medals.

He enriched the national collection of the British Museum by presenting it with a collection of oriental coins.

After staying a year and a half in Europe, he returned to the East, and on his second arrival in India, he was sent on a mission to Hydrabad, which was entirely successful. The next, and unfortunately the last public duty in which he was employed was in a mission to Cabul, where those political events occurred which occasioned his falling a victim in his country's service at the early age of 36.

Such is a brief statement of the very active life of a man endowed by nature with an extraordinary variety of powers. Personally active and enterprising, he united to the qualities of the accomplished soldier and statesman those of the philologist and philosopher. What might we not have hoped from such a man, if Providence had seen right to prolong his days!

Sir Alexander was of a lively and playful disposition, and most amiable in private life. He was one of the best of sons and kindest of brothers.

George Fitzclarence, Earl of Munster, was born January 29, 1794. He entered the army at an early age, and served in the Peninsular war. He afterwards went to India, where he assiduously and successfully studied the Sanscrit, Arabic, and Persian languages. In 1818 he was entrusted with despatches announcing the conclusion of the Mahratta war; he seized the opportunity of acquiring and imparting additional knowledge, and travelled home by an overland route, publishing an account of his journey. He was created Earl of Munster soon after the accession of his late Majesty, William the Fourth.

Shortly after his return from India, he was elected a Vice-President of the Asiatic Society, and by his personal exertions procured much valuable information on oriental geography and statistics, and on the natural productions of India. He subsequently took a very active part in promoting the Oriental Translation Fund, and also the Society for the publication of Oriental Texts, and the Association formed for the purpose of increasing our knowledge of the countries south of Egypt. For the last fourteen years, he devoted great labour to the collection of materials for the compilation of a military history, and history of the civilization of the Mahommedan nations. Of this elaborate and important work, which was nearly completed, a long and interesting account is given in the Asiatic Journal. It is to be hoped that the friends of Lord Munster will not allow these labours to have been performed in vain.

It is needless for me to add what a severe loss his lordship's death must be to those who are interested in oriental pursuits, and indeed to his country itself, when we reflect on the large empire held by England in the eastern regions of the globe.

Lord Munster married Miss Wyndham in 1819, and has left a family to lament his death. He was elected President of the Asiatic Society only a short time before his decease.

Richard Hussey, Lord Vivian, was educated at Harrow, and entered the army as an ensign in the year 1793. In 1803, he became a major; Lieutenant-Colonel in 1804; and Colonel in 1812. He was promoted to the rank of Major-General in 1814, and Lieutenant-General in 1830. His first active service was under his late Royal Highness the Duke of York in Flanders. Under Sir John Moore, he commanded the 7th Hussars in 1808 and 1809, and a brigade of cavalry from September 1813 to the termination of the Peninsular war. He was present at the battles of Orthes, Nivelle, and Toulouse; and near the latter place was severely wounded. He also partook of the glory of Waterloo.

Lord Vivian represented his native town of Truro in 1820; subsequently, the borough of Windsor; and lastly, the eastern division of Cornwall in Parliament. He was Commander-in-Chief in Ireland from the year 1831 to 1835, when he filled the office of Master-General of the Ordnance under Lord Melbourne. He received a peerage in 1841, and retired from office at the same time as the ministry which he had supported.

Lord Vivian was Colonel of the 1st Guards at the time of his death. He was universally beloved by those who knew him in private life. As an officer, he was accessible to all, and indefatigable in his exertions in the public service, and few have been held in greater esteem by those under their command.

In the performance of his official duties as Master-General of the Ordnance, he evinced a due sense of the importance of science to the national welfare. He zealously forwarded the views of the Royal Society, and of the British Association, for the promotion of Magnetical Science, by the establishment of magnetical observatories. He highly approved of the employment, to a limited extent, and in time of peace, of the officers and soldiers of the Ordnance department in national scientific undertakings, and gave much consideration to the means by which the objects of the joint application of the above-named Societies might be obtained.

He was also the advocate for the Museum of Economic Geology, and an earnest promoter of the Trigonometrical Survey of the British empire.

John Yelloly, M.D., was born in 1773, at Alnwick in Northumberland, and received his early education at a school in that town. He chose medicine as his profession; and at the age of 20, went to Edinburgh, and after going through the usual course of

study in its University, graduated there in 1796. Four years afterwards, he settled in London, and became a Licentiate of the College of Physicians. In 1806, he married Miss Tyssen, heiress to a considerable landed estate; and established himself in Finsbury Square. About this time, also, he was elected Physician to the Aldersgate-street Dispensary; and, in 1817, succeeded Dr. Cooke as Physician to the London Hospital. He became a Fellow of this Society in 1814.

Endowed by nature with great activity of mind, Dr. Yelloly applied himself with indefatigable industry to the acquisition and the extension of medical knowledge. His views were not confined to the narrow circle of his own individual advancement, but, embracing a wider range of utility, they extended not only to the improvement, but also to the general diffusion of science, and to whatever was calculated to raise the character and exalt the dignity of the profession to which he belonged. This liberal public spirit, indeed, was, throughout life, the main spring of his exertions; and one of its principal fruits was the formation, in conjunction with his friend Dr. Marcet, of the Medical and Chirurgical Society of London. The objects contemplated by such an institution were to establish a closer bond of union than had previously existed among the several branches of the medical profession; to collect a comprehensive medical library for their use; to read and discuss medical papers at the evening meetings; to publish a selection of these papers in the form of Transactions; to promote a free interchange of information, and to cultivate liberal and kindly feelings among the members. Many of the most eminent practitioners, both in Medicine and Surgery, were invited to join this new Society, which, from small beginnings, soon increased in numbers and in reputation, so as in the course of a few years to comprise a large portion of the professional rank and talent of the metropolis. It was to the active exertions and persevering zeal of its two founders that this Society was mainly indebted for its early success and its continued prosperity, amidst occasional difficulties with which it had to contend. Dr. Yelloly, in particular, devoted himself to its welfare with the attachment of a parent. At its commencement he officiated as Secretary, in conjunction with Mr. Charles Aikin; and for many years he was scarcely ever absent from its meetings, taking a lively interest in all its proceedings, and an active part in the discussions of the evening. To its Transactions he contributed many valuable memoirs*. At a later period, about

* These contributions were the following:—

1. A case of tumour in the brain, with remarks on the propagation of nervous influence. (November 29, 1808. Medico-Chirurgical Transactions, vol. i. p. 181.)

2. History of a case of Anæsthesia. (March 11, 1812. Ibid. vol. iii. p. 90.)

3. Observations on the vascular appearance in the human stomach, which is frequently mistaken for inflammation of that organ. (July 24, 1813. Ibid. vol. iv. p. 371.)

4. Particulars of a case in which a very large calculus was removed from the urethra of a female without operation; with examples of analogous cases. (June 20, 1815. Ibid. vol. vi. p. 574.)

the year 1814, under the presidency of Sir Henry Halford, Dr. Yelloly, Dr. Marcet, and other influential members, conceiving that great advantages would result to the Society, and its permanence be better secured, by its being incorporated under a Royal Charter, took the proper measures for accomplishing this object. The necessary forms were gone through, and the grant was on the eve of being signed, when an unexpected opposition was suddenly raised by the College of Physicians, who finally prevailed on the Privy Council to refuse the prayer of the petitioners. Dr. Yelloly, however, lived to see the great change which has since taken place in the spirit of the times; for, in the year 1834, his favourite scheme was realised, all opposition had subsided, and the Society obtained at once from the Crown the Charter under which it is now constituted as the Royal Medical and Chirurgical Society of London.

Although Dr. Yelloly diligently availed himself of the extensive opportunities afforded by his public appointments, and had acquired universal respect and esteem by the suavity of his manners and the kindness of his disposition, it is remarkable that he nevertheless failed to obtain more than a very moderate share of private practice. In course of time his family had become very numerous, while his professional income was by no means increasing in an equal ratio; and prudential motives prevailing over his attachment to the metropolis, he at length determined to quit London, and establish himself at Carrow Abbey, in the immediate vicinity of Norwich. He resided there during many years, engaged in practice: he was soon elected one of the Physicians of the Norfolk and Norwich Hospital, and introduced into that establishment many useful reforms. It was during this period that he undertook the examination of the urinary calculi, of which the Hospital contained a large collection. He communicated to the Royal Society the result of his labours in a paper which was published in the volume of our Transactions for 1829*. In this paper he gives an account of the structure and chemical composition of 330 calculi, which had either been purposely divided or accidentally broken in their extraction. The results are arranged in tables, exhibiting, in the order of their superposition from the centre, the consecutive deposits of which each calculus is composed. It appears from these tables, that not less than two-thirds of all urinary calculi consist of the lithates, or have those substances for their nuclei: whence Dr. Yelloly inferred the probability that a large proportion of them owe their existence to the previous formation of such a nucleus, and was led to suspect that carbonate of lime, although

---

5. Case of preternatural growth in the lining membrane covering the trunks of the vessels proceeding from the arch of the aorta. (July 8, 1823. Ibid. vol. xii. p. 565.)

6. Observations on the statement made by Dr. Douglass, of Cheselden's improved lateral operation of lithotomy; in a letter to Sir Astley Cooper, Bart., F.R.S. (April 14, 1829. Ibid. vol. xv. p. 339.)

7. Observations on vascular appearances of mucous and serous membranes, as indicative of inflammation. (Ibid. vol. xx. p. 1.)

* p. 55.

rarely found in a separate form in calculi, is not an unfrequent concomitant of phosphate of lime. With the assistance of Dr. Prout and Mr. Faraday, he ascertained the presence of carbonate of lime in some of the specimens which were not previously supposed to contain it; a result which was confirmed by the analysis of several calculi from the collection of the Hunterian Museum, and also from the Museum of Guy's Hospital.

He presented to the Society, two years afterwards, a sequel to this paper, recording, in a tabular form, the analysis of 335 additional specimens, which had, in the interval, been divided*. The most remarkable fact noticed in this memoir, is the presence of silex in a few specimens. Dr. Yelloly finds reason to believe that the average number of calculous disorders occurring in Scotland has been much underrated; that, on the other hand, the proneness to these complaints is very small in Ireland; and that, on the whole, a much larger proportion of calculous cases occurs in towns than in the country.

For some years before his death, Dr. Yelloly had relinquished practice, and resided at Woodton Hall, near Bungay; his attention being chiefly turned to agricultural pursuits. From thence he removed, about two years ago, to Cavendish Hall, in the neighbourhood of Clare, in Suffolk; where, in February last, his valuable life was suddenly terminated by an attack of apoplexy, while taking an airing in his carriage.

The Earl of Macclesfield was born on the 24th of February, 1755. He married, 25th of May 1780, Mary Frances, daughter and coheir of the Rev. Thomas Drake, and died last March at the advanced age of eighty-seven. He was Lord Lieutenant of the county of Oxford. In former times he used often to attend the meetings of the Royal Society; to which, indeed, it was natural that he should feel something of an hereditary regard, descended as he was from one of our former Presidents.

Among those Fellows whose loss by death this Society has to deplore since my last annual address, Mr. Gage Rokewode should not be forgotten.

This gentleman, long so well known for the admirable manner in which he discharged the duties of Director of the Society of Antiquaries, was the youngest son of Sir Thomas Gage of Hengrave, in Suffolk, the sixth Baronet of that ancient family.

If this were a fit place from which to pronounce an eulogium on private worth of the highest order, the memory of no one could deserve it better, and to his friends (and no one had more) the loss is irreparable. But to the public also the loss is most considerable, and to this more particularly it is my duty to refer.

At an early period of his life he evinced an attachment to the study of those antiquities for the knowledge of which he afterwards became so eminent. I need but refer to the pages of the 'Archæo-

* Phil. Trans. for 1831, p. 415.

logia' and 'Vetusta Monumenta' for proofs of his varied learning, his indefatigable zeal and industry, and his careful accuracy on every one of the many subjects which he touched. His last and perhaps one of his most valuable communications to the Society of Antiquaries, of which he was one of the brightest ornaments (I allude to his paper on the Painted Chamber at Westminster), was completed just before his death. I must not omit to refer also to those beautiful works, in which he so carefully and ably illustrated the history of the ancient and curious seat of his own family, Hengrave Hall, and that portion of Suffolk in which it is situated. Throughout all these varied and laborious pursuits, he displayed not only all the qualifications of a most able and careful antiquary, but also a disposition the most kind-hearted, and a tone of mind the most courteous towards the opinions and feelings of others, as well when differing from them in opinion, as when compelled to notice their errors in the same path of antiquarian learning.

Much as he had done, how much more might not yet have been expected from the labours of one so gifted, had not his life been suddenly and unexpectedly brought to a close!

Lieutenant Wellstead, of the Indian Navy, was a distinguished traveller in the East. He was the author of a notice on the ruins of Berenice, of a journey into the interior of Oman, and of a journey to the ruins of Nahab el Hajar, published in the Transactions of the Royal Geographical Society. He died in the month of October last. He received a severe injury on the head while in India, which was the remote cause of his early and lamented death.

Mr. Hennell, the chemical operator at Apothecaries' Hall, lost his life by an extraordinary accident; he was mixing a large quantity of fulminating mercury for the service of the army in India, and being desirous that it should be of an uniform colour, the whole was placed in a large evaporating dish; as he was stirring it, an explosion of the whole took place, which was attended with his complete destruction, many parts of the body being thrown to a considerable distance. He was an eminent chemist, and had furnished two papers to our Transactions.

It is now, Gentlemen, time for me to perform the most agreeable part of the duty which falls to the lot of a President on your Anniversary—that of giving the Medals awarded by the Council. As we have not the pleasure of seeing here today Mr. MacCullagh, I shall beg Mr. Wheatstone, as his friend, to transmit his Medal to that gentleman.

Mr. Wheatstone.

It gives me great satisfaction to be the organ of the Council of the Royal Society in bestowing on your friend Mr. MacCullagh the Copley Medal. It is needless for me to dilate on the profound mathematical skill and exemplary diligence with which he has explained

the laws of the undulatory theory of light. Philosophers more able than myself to appreciate their merits, have given their testimony to the great value of his discoveries, and to the elegant means that he has employed. It is the sincere wish of us all, that these labours may be followed by others as important to science and as honourable to the University of Dublin; an University that numbers Mr. MacCullagh among the most eminent of her sons.

The Council have awarded the Copley Medal for the present year to Professor MacCullagh, for his researches connected with the wave-theory of light, contained in the Transactions of the Royal Irish Academy. The grounds on which they have made this award are the following. One of the most important steps made in the physical theory of light, since it was first promulgated by Huygens, is, undoubtedly, Fresnel's discovery of the laws of refraction by crystallized media, embodied in his 'Mémoire sur la double réfraction.' The object proposed by Professor MacCullagh, in his first paper *, was to simplify and to develope that theory. He has shown in this paper, that the elastic force of the luminiferous æther may be represented, in magnitude and direction, by means of an ellipsoid, whose semiaxes are the three principal refractive indices of the medium; and he has thence deduced, in a geometrical form, the leading results of Fresnel's theory. This ellipsoid is closely related to the generating ellipsoid of Fresnel; and by the aid of these relations, Professor MacCullagh has demonstrated, in a very simple manner, the truth of Fresnel's construction of the wave-surface, the demonstration of which had been left imperfect by its author.

In Mr. MacCullagh's next paper, entitled "Geometrical propositions applied to the Wave-theory of Light†," he has examined the properties of a surface, which he calls the *surface of indices*, and which had presented itself likewise in the researches of M. Cauchy and Sir William Hamilton; and he has shown that it affords a general and exact construction for the *interval of retardation* of the two rays in their passage through a double-refracting crystal; and thus that the forms of the rings, or isochromatic curves, which had previously been deduced only by approximate methods, may be determined generally.

The next paper of Professor MacCullagh is that "On the Double Refraction of Quartz‡;" a subject which had engaged the attention, successively, of Biot, Fresnel, and Airy. The first of these writers had determined experimentally the laws of rotatory polarization, which take place when a ray is transmitted along the axis of rock-crystal; and the second had shown that these laws were explained by the interference of *two circularly polarized* rays, which are transmitted *along the axis* with different velocities. The next step in this curious subject was made by Mr. Airy, who examined the peculiar phenomena of refraction by quartz in *other directions*, and showed that they were accounted for by the supposition of two *elliptically polarized* rays, the ratio of the axes of these elliptical vibrations va-

* Transactions of the Royal Irish Academy, vol. xvi.
† Ibid. vol. xvii. ‡ Ibid.

rying with the inclination of the rays to the axis of the crystal. Lastly, Professor MacCullagh has shown that both the circular polarization of the rays in the axis, and the elliptical polarization of the rays inclined to it, may be explained by a certain assumed form of the differential equations of vibratory movement, which not only links together the two classes of phenomena, but also affords a mathematical expression for their laws. The general theory, to be alluded to presently, has enabled him to explain the origin of these assumed forms of the differential equations.

The theory of reflexion at the surfaces of uncrystallized media had been given by Fresnel, although apparently on erroneous principles. The more complex case of reflexion at the surfaces of crystals was left by him to his successors; and the discovery was made independently, and nearly at the same time, by Professor MacCullagh* and M. Newmann of Königsberg. The discovery is not only important in itself, as bringing within the domain of the wave-theory a large class of hitherto unexplained phenomena, but perhaps still more on account of the physical principles upon which it is based, and the constitution of the luminiferous æther which it renders probable. Thus, it is assumed in this theory, in opposition to the hypothesis of Fresnel, that the *vibrations are parallel to the plane of polarization*, and that the *density of the æther is the same in all media*. These, together with the law of the *vis viva*, and the beautiful principle of the *equivalence of vibrations* (but half perceived by Fresnel), form the foundation of the theory of crystalline reflexion, and derive the highest probability from its accordance with phenomena. The results of the theory are embodied in geometrical constructions of great elegance, which determine generally the plane of polarization of the reflected ray, and the amplitudes of the reflected and refracted vibrations.

Hitherto the laws of reflexion at the separating surface of two media were apparently unconnected with those which govern the propagation of light in the same medium. It remained to connect these laws as parts of one and the same system, and to trace the hypothetical principles upon which each theory was based, up to some higher mechanical principle. This crowning point of the theory has been attained by Professor MacCullagh†. Employing the general processes of analytical mechanics, as laid down by Lagrange‡, and limiting the general theorems solely by the conditions that the density of the æther is *constant*, and that the vibrations are *transversal*, he

* "On the laws of crystalline reflexion and refraction." Transactions of the Royal Irish Academy, vol. xviii. This memoir has been honoured by the Medal of the Royal Irish Academy.

† Proceedings of the Royal Irish Academy for December 1839. The complete paper has not yet been published.

‡ Mr. Green appears to have been the first to apply these methods to the dynamics of light, in a paper on the laws of reflexion and refraction at the surfaces of uncrystallized media, published in the Cambridge Transactions. He has failed, however, in assigning the form of the principal function, and has consequently been led to erroneous results.

has succeeded in deducing, as parts of one and the same general theory, not only the laws of propagation in the same medium, previously discovered by Fresnel, but also the laws of reflexion which take place at the bounding surface of any two media, already discovered by himself and M. Newmann. The same theory has likewise led to the *demonstration* of those physical principles, which had been *assumed* in the former paper. It has shown that the *vis viva* is necessarily preserved, in the passage of light from one medium into another; that the resultants of the vibrations are the *same in the two media*; and finally, that the vibrations themselves are *parallel to the plane of polarization*.

This seems to be the most advanced point to which the physical theory of light, in its present form, is capable of being pushed; and it is only by the addition of *new physical principles*, and further insight into the constitution of the luminiferous medium, that any ulterior progress can be expected.

Mr. Fox Talbot.

The many important discoveries made by you in Photography, discoveries to which I have adverted when addressing the Society on another occasion, discoveries which seem, with those of an analogous nature made by a Neipse and a Daguerre, to open to us the vista of discoveries still more vast and curious, undoubtedly well entitle you to the honour of the Rumford Medal at our hands. Your papers, indeed, have been so great an ornament to our volumes, that we can never sufficiently express our thanks to you for them. I trust that you will not desert so promising a line of inquiry, and that our Transactions may receive from you still greater acquisitions of knowledge in the path which is traced by light itself.

Mr. Bowman.

It must be always satisfactory for a President of the Royal Society to present to one of your profession a Royal Medal for labours which have as their instruments, the assiduous application of the noblest faculties of reason—as their immediate purpose, the knowledge of the sublime truths contained in the wonderful adaptations of the organs of created beings—and as their ultimate end, the cure of disease, the alleviation of agony, and the prolongation of human life. Gentlemen of your own valuable profession have given their testimony to the importance of your discoveries, and the Council feels pleasure in rewarding your zeal and talents. To you, and all who, like you, are employed in these noble pursuits, all here will say with me, may God prosper your labours to His glory and to the happiness of His creatures.

Mr. Daniell.

The continued intercourse that I have had with you in the Council of the Royal Society increases the pleasure which I experience in giving into your hands this Medal. Electrical Chemistry, at all times of great importance as giving us an insight into the most recondite laws of nature, has now acquired additional interest by the

practical purposes to which a Wheatstone, a Spencer, a Jacobi, and others have applied it. Its connection with magnetism seems to promise still greater discoveries than those that have already immortalised a Davy and a Faraday. You have pursued this difficult branch of Chemistry with signal success, and the Council have approved of the recommendation of the Chemical Committee, that one of the Royal Medals should be conferred on you for the valuable papers which you have contributed to our Transactions. I trust that our future volumes may be still more enriched by the result of your scientific labours.

The Statutes relating to the election of Council and Officers having been read, and Joseph Smith, Esq., and Alfred Smee, Esq., having, with the consent of the Society, been nominated Scrutators in examining the lists, the votes of the Fellows present were collected.

Dr. Roget, on the part of the Scrutators, reported the following Gentlemen as being duly elected Officers and Council for the ensuing year, viz:—

President.—The Marquis of Northampton.

Treasurer.—Sir John William Lubbock, Bart., M.A.

Secretaries. { Peter Mark Roget, M.D.
Samuel Hunter Christie, Esq., M.A.

Foreign Secretary.—John Frederic Daniell, Esq.

Other Members of the Council.—George Biddell Airy, Esq., M.A., A.R.; Francis Baily, Esq.; Martin Barry, M.D.; Henry James Brooke, Esq.; Robert Brown, Esq., D.C.L.; Rev. James Cumming, M.A.; John Thomas Graves, Esq., M.A.; Sir William J. Hooker, K.H., LL.D.; Robert Lee, M.D.; Gideon A. Mantell, Esq., LL.D.; William Hallows Miller, Esq., M.A.; William H. Pepys, Esq.; George Rennie, Esq.; The Earl of Rosse; William Henry Fox Talbot, Esq.; Charles Wheatstone, Esq.

The thanks of the Meeting were given to the Scrutators for their trouble in examining the lists.

The following is the statement of the Receipts and Payments of the Society during the preceding year, which was laid on the table by the Treasurer:—

Statement of the Receipts and Payments of the Royal Society between Nov. 29, 1841, and Nov. 29, 1842.

RECEIPTS.

				£	*s.*	*d.*
Balance in the hands of the Treasurer at the last Audit ..				609	2	8
24 Weekly Contributions, at one shilling	62	8	0			
221 Quarterly Contributions at £1.....	848	0	0			
				910	8	0
20 Admission Fees				200	0	0
4 Compositions for Annual Payments at £40				160	0	0
Carried forward				1879	10	8

	£	s.	d.	£	s.	d.
Brought forward				1879	10	8
5 Compositions for Annual Payments at £60.....				300	0	0
Received of Wm. A. A. White, Esq., F.R.S., for Donation Fund				10	0	0
Received of Messrs. Ranking for sums paid on account of the Pacha of Egypt.....				312	3	0
August 10, Received of Messrs. Ranking on account of the Magnetic Observatory of Egypt, being Allan and Co's. account for Books				33	6	0
Rents:—						
One year's rent of estate at Mablethorpe: due at Michaelmas 1842	88	14	3			
One year's rent of lands at Acton: due at Michaelmas 1842	70	0	0			
One year's fee-farm rent of lands in Sussex; land-tax deducted: due at Michaelmas 1842	19	4	0			
One-fifth of the clear rent of an estate at Lambeth Hill, from the Royal College of Physicians, in pursuance of Lady Sadleir's will: due at Midsummer 1842	3	0	0			
				180	18	3
Dividends on Stock:—						
One year's dividend on £14,000 Reduced 3 per cent. Annuities	420	0	0			
Less Income Tax	6	2	6			
				413	17	6
One year's dividend on 3452*l.* 1*s.* 1*d.* Consols, the produce of the sale of the premises in Coleman-street.....	103	11	2			
Less Income Tax	1	10	2			
				102	1	0
One year's dividend on £200 Consols	6	0	0			
Less Income Tax	0	1	9			
				5	18	3
Donation Fund.						
Half year's dividend on.... £4544 16 9	68	3	5			
Ditto ditto on.... 4843 14 7	72	13	1			
	140	16	6			
Less half year's Income Tax..	2	2	5			
				138	14	1
Rumford Fund.						
One year's dividend on 2292*l.* 11*s.* 7*d.* Consols	68	15	6			
Less Income Tax	1	0	0			
				67	15	6
Carried forward				3444	4	3

	£	s.	d.	£	s.	d.
Brought forward . . .				3444	4	3
Fairchild Fund.						
One year's dividend on £100 New South Sea Annuities	3	0	0			
Sir Clifton Wintringham's Bequest.						
1842. Six years' dividends on 1200*l*.....	216	0	0			
July Half year's dividend on ditto £18 0 0						
Less Income Tax 0 10 6						
	17	9	6			
				236	9	6
Miscellaneous Receipts:—						
Sale of Philosophical Transactions, Abstracts of Papers, and Catalogues of the Royal Society's Library				272	2	1
Sale of 4 Scientific Catalogues to Subscribers and 2 old Catalogues				2	5	0
Credited by Bankers unknown				4	0	0
Total Receipts				£3959	0	10

PAYMENTS.

	£	s.	d.
Fairchild Lecture.—The Rev. J. J. Ellis, for delivering the Fairchild Lecture for 1842	3	0	0
Bakerian Lecture.—James D. Forbes, Esq., for the Bakerian Lecture for 1842	4	0	0
Rumford Fund.—Mr. Wyon, for Gold and Silver Rumford Medals	64	0	0
Ditto, for Six Copley Medals	32	2	0
Donation Fund.—Dollond, for Telescope for Sir David Brewster	53	6	0
By purchase of £298 17*s*. 10*d*. 3 per Cent. Consols ..	266	15	3

Books purchased:	£	s.	d.			
Bailliere: for purchase of Books at Audouin's Sale	105	17	3			
Nutt: for Books	13	3	4			
Stibbs: for ditto	4	10	0			
Simpkin and Co., for ditto	5	17	6			
Maynard: for ditto	9	1	6			
				138	9	7
Carried forward . . .				561	12	10

	£	s.	d.	£	s.	d.
Brought forward . . .				561	12	10
Allan and Co. :—						
For Books for the Magnetic Observatory of Egypt.....				33	6	0
Mr. Amyot, Treasurer of the Society of Antiquaries:						
The moiety of the Expenses for repairing the Lamps on Staircase				7	1	9
Salaries :—						
Dr. Roget, one year, as Secretary	105	0	0			
S. H. Christie, Esq., one year, as Secretary..	105	0	0			
Ditto for Index to Phil. Trans.	5	5	0			
John F. Daniell, Esq., one year, as For. Sec.	20	0	0			
Mr. Roberton, one year, as Assistant-Secretary	200	0	0			
Mr. W. E. Shuckard, one year, as Librarian..	50	0	0			
G. Holtzer, one year, as Porter	30	0	0			
Ditto, for extra Porterage	10	0	0	525	5	0
Few, Hamilton and Few, Solicitors:						
Law Expenses	45	11	0			
Ditto, Mablethorpe Tithe Suit, Society's proportion of the Costs of Appeal	110	0	0			
Ditto, ditto, for the Balance of the Costs of the Suit.....	53	13	3	209	4	3
***Sir Clifton Wintringham's Bequest*:**						
Loscombe Suit :—Paid to the Foundling Hospital.....	100	0	0			
Ditto, for the Costs of ditto	25	7	6			
Ditto, for the Attorney-General's Costs....	13	14	2	139	1	8
Fire Insurance, on the Society's Property				48	8	3
Mrs. Coppard: Gratuity.....				10	0	0
Bills :—						
Taylor:						
Printing the Phil. Trans., 1841, part 2 ..	132	15	0			
Ditto, 1842, part 1.....	88	13	6			
Ditto, Proceedings, Nos. 49—54; Circulars, Lists of Fellows, Ballot-lists, Statement of Payments, and Minutes of Council; &c. &c.	115	15	6	337	4	0
Carried forward . . .				1871	3	9

	£	s.	d.	£	s.	d.
Brought forward . . .				1871	3	9
Bowles and Gardiner:						
For Paper for the Phil. Trans., 1841, part 2, and 1842, part 1						
				118	15	0
Basire:						
For Engraving and Copper-plate printing for Phil. Trans., 1841, part 2	92	14	3			
Ditto, for 1842, parts 1 and 2, and miscellaneous printing	255	6	3			
				348	0	6
Gyde:						
Boarding and Sewing 800 Parts of Phil. Trans., 1841, part 2	27	5	4			
Ditto, 1842, part 1	27	5	4			
				54	10	8
McDonald and Leslie:						
For Pedestal for Mrs. Somerville's Bust	11	10	0			
Tuckett:						
Bookbinding	68	18	0			
Pouncey and Sons:						
For Stationery	11	12	9			
Saunderson:						
For Shipping Expenses	9	15	1			
Brecknell and Turner:						
Wax Lights, Candles, and Lamp Oil	34	17	0			
Cubitt:						
For Alterations in Library, Lower Library, and Council Room, and repairing and relaying Carpets, &c.	43	5	0			
Clerks: Christmas Fee	1	1	0			
Arnold:						
For Coals	24	13	0			
Ditto (Porter's yearly allowance)	4	7	0			
Murray:						
For taking Meteorological Observations	7	0	0			
Gwillim:						
Mats, Brushes, Fire-wood, &c.	6	0	1			
Snell:						
New Blinds for Meeting, Council, and President's Rooms, and cleaning Curtains, &c. . .	33	19	4			
Copeland:						
China for Tea	3	17	0			
				260	15	3
Taxes and Parish Rates:						
Land and Assessed Taxes	21	14	1			
Poor Rate	20	11	4			
Church Rate	5	15	8			
Carried forward . . .	48	1	1	2653	5	2

	£	s.	d.	£	s.	d.
Brought forward . . .	48	1	1	2653	5	2
Rector's Rate	1	9	0			
Sewer's Rate	2	2	6			
				51	12	7
Petty Charges:						
Mr. May, assisting Mr. Shuckard with Catalogue thirty weeks	37	4	2			
Postage and Carriage	12	3	9			
Expenses on Foreign Packets, &c.	12	4	2			
Stamps	0	15	0			
Charwoman's Wages	27	6	0			
Ditto, Extra work	2	5	0			
Miscellaneous expenses	14	14	7			
Library and Window-cleaning, &c.	2	7	0			
				108	19	8
Total Payments				£2813	17	5
Total Receipts and Balance				3959	0	10
Balance in the hands of the Treasurer				£1145	3	5

JOHN W. LUBBOCK, *Treas.*

Nov. 29th, 1842.

The Balances in hand, now belonging to the several trusts, are as under: viz:—

	£	s.	d.
Donation Fund	95	8	1
Rumford Fund	72	11	0

The following table shows the progress and present state of the Society, with respect to the number of Fellows:—

	Patron and Honorary.	Foreign.	Having compounded.	Paying £2 12s. Annually.	Paying £4 Annually.	Total.
November 1841	12	46	528	25	216	827
Since elected	+ 1	+ 4	+ 7	.....	+ 13	25
Since compounded	.....	.....	+ 2	.....	− 2	
Since deceased, &c.	.....	.....	− 20	− 1	− 5	−26
Ejected	.....	.....	− 1	.....	.....	−1
November 1842	13	50	516	24	222	825

Weekly and Quarterly Contributions.

1830	£363	4	0	1837	531	0	0
1831	286	0	0	1838	599	4	0
1832	255	6	0	1839	666	16	0
1833	283	7	6	1840	767	4	0
1834	318	18	6	1841	815	12	0
1835	346	12	6	1842	910	8	0
1836	495	0	0				